

## LITERATURE CITED

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**The Immature Stages of *Hesperoconopa*  
*dolichophallus* (Alex.)**  
(Diptera : Tipulidae)<sup>1</sup>

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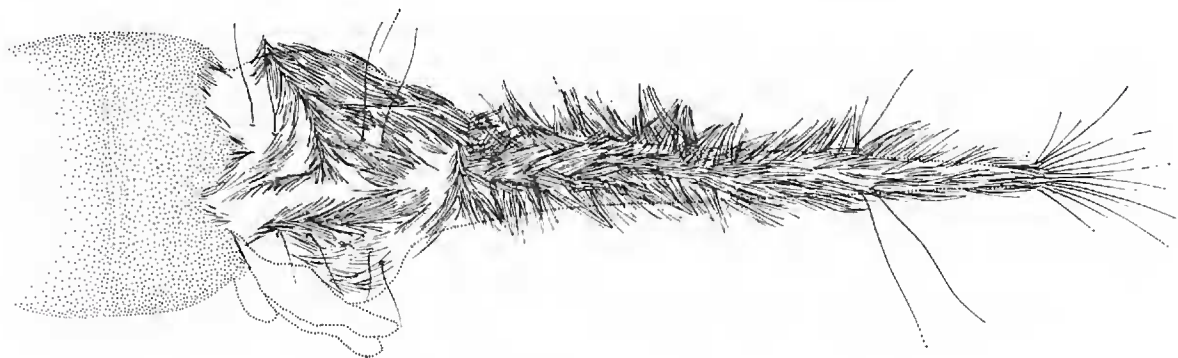
There are five species of *Hesperoconopa* now recorded from the continental United States. The immature stages and their habitats are not described although Alexander (1948, 1949) has indicated that they must be either aquatic or subaquatic. Several larvae and pupae of *Hesperoconopa dolichophallus* (Alex.) were taken in the backwaters and small tributaries of the White River in Mount Rainier National Park, Washington. Second, third, and fourth instar larvae, and pupae were found in patches of fine to coarse sand which were submerged beneath depths of one to twelve inches of swiftly flowing, cold water. Pupae were also taken from habitats where the water had recently receded. The larvae are difficult to separate from those of the genus *Dicranota*, with which they are associated, because of similarity of body coloration, but closer examination reveals the typical eriopterine head capsule of *Hesperoconopa*. The following description is based on ten last instar larval specimens and will serve for all instars except the first, which has not been observed. The pupal description is based on one male and seven female specimens.

**HESPEROCONOPA DOLICHOPHALLUS (Alexander)**

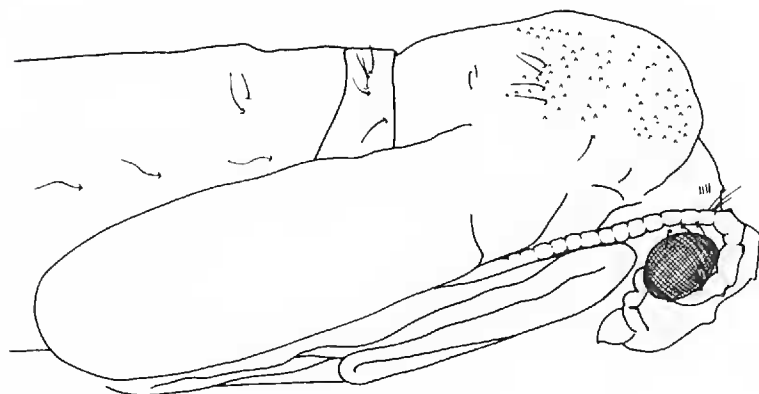
*Last Instar Larvae*.—Length 10.4–12.6 mm; dextrosinistral and dorsoventral diameters both 0.5–0.6 mm. Body brown, elongate, vermiform, tapering slightly anteriorly. Seventh abdominal segment with dark ring of setae at posterior margin;

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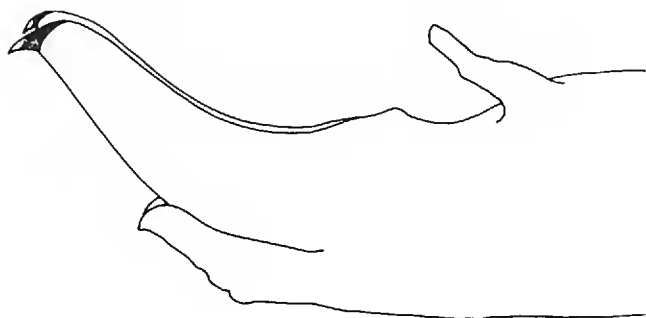
<sup>1</sup> This investigation is supported by National Science Foundation Grant GB-4532.



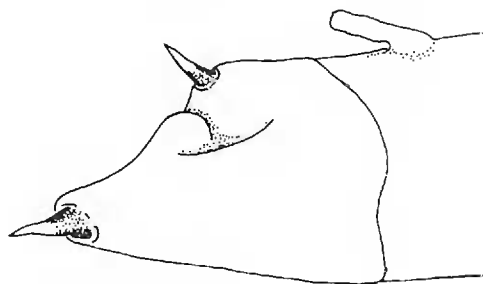
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FIG. 1. Lateral view of terminal segments of *H. dolichophallus*. FIG. 2. Lateral view of anterior end of *H. dolichophallus*. FIG. 3. Lateral view of female cauda of *H. dolichophallus*. FIG. 4. Lateral view of male cauda of *H. dolichophallus*.

occasionally expanded because of invagination of terminal segments. Ninth abdominal segment extremely setulose, with elongate pencils of setae (fig. 1), bifurcate at extreme tip, lacking spiracles. Four opaque, white anal lobes, posterior pair slightly longer than anterior pair, latter often retracted in preserved specimens. Length of head capsule 0.425–0.442 mm; dextrosinistral diameter at mandibular articulation 0.102–0.119 mm; antennal length and width subequal; maxillae bilobed and blunt with anterior apices not extending beyond anterior margin of labrum; lateral and ventral bars spatulate, directed sharply mesad at posterior margins,

ventral bars blunt with no teeth at anterior ends; dorsal bars not spatulate posteriorly; ocular plates membranous except for area just anterior to premaxillary suture; anteclypeal fold from posterior edge of mandibular articulation curved mesally and cephally continuing caudally to slightly arcuate antennal buttress; lateral bar separated from antennal buttress and dorsal bar by suture; lateral areas of clypeus lightly sclerotized back and slightly beyond level of posterior margin of antennal buttress, medial area membranous; frons membranous to posterior quarter of head capsule; posterior quarter of frontal area sclerotized on either side of membranous medial area, joining at tip with no apparent suture.

*Pupa*.—Length 5.6–7.0 mm; females slightly longer than males; dextrosinistral and dorsoventral diameters both 0.79–0.90 mm. Body terete, gradually tapering from thorax to cauda, thorax and wing pads black, abdomen white with cauda dark brown to black. Cephalic crest bearing two tubercles on either side of midline, ventral tubercles smaller, dorsal tubercles curving ventrally, with elongate setae at tip; pronotum smooth, dark brown to either side of medial white vitta, lateral edge with three elongate setae; anterior margin of mesonotum (fig. 2) with two or three irregular spines adjacent to midline, shorter spinous processes scattered over surface extending from pseudosuture over dorsal crest to just beyond midlength of notum; face of dorsal crest dark brown, remainder of notum light brown, mesonotal breathing horns absent, or at most, represented by small patch of delicate, short setae, metanotum slightly darkened and roughened by small folds medially, armed with four setae near lateral margins, bases of halteres bulbous. Roughened area on anterior third of abdominal segments three through seven, elongate pencils of setae present on all segments. Eye sheath roughened with two small spines arranged transversely on scape, pedicle, and first flagellar segments, one spine on each following segments progressively smaller toward tip of flagellar sheath; leg sheaths roughened with outer sheaths extending nearly to posterior margin of roughened area of third abdominal segment. Female cauda (fig. 3) with dorsal ventral sheath curving upward with tip having spines directed abruptly basally and laterally, ventral sheaths elongated with tips angling dorsally, then curving ventrally; male cauda (fig. 4) with black tubercle armed with yellow spine arising from outer ventral margins of both sheaths of outer dististyles, second set of spinous tubercles arising from tips of tergal arms, directed dorsally and caudally.

The larvae of this genus may be separated from the larval forms of all other genera on the basis of the cone-shaped caudal end. The pupal forms may also be readily identified by the retention of this structure as a finger-shaped projection on the homologous segments of the pupal cauda. Characteristics such as the elongate pencils of setae, reduction of the pupal breathing horns, and the body movements of *Hesperoconopa* are very similar to those of the genus *Cryptolabis* (Hynes, 1963) and to a lesser extent the genus *Rhabdomastix*, and must indicate the close relationship of these genera.

#### LITERATURE CITED

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## An Annotated Bibliography of Literature on Salt Marsh Insects and Related Arthropods in California

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The Pacific Coast Entomological Society in 1966 established a special committee whose concern was to be "the salt marsh habitat." The Society voted to undertake the encouragement of the publication of notes and observations of insects and other related arthropods of the salt marsh, particularly of central California.

In order to facilitate such work, the following annotated bibliography is presented.

Standard references, indexes and abstracts were employed in developing this bibliography. Only references appropriate to California are included in this manuscript. An extended series of references on salt marsh arthropods are on file at the Entomology Departments of the California Academy of Sciences in San Francisco and at San Francisco State College. This bibliographic file will be kept as current as possible.

The greatest share of the references in the literature refer to European salt marshes. It is our opinion that a considerable body of information exists in the literature relating to the species of terrestrial arthropods inhabiting the salt marsh environment. However, most of these sources of information are not available to a search based upon words or phrases indicating the specific habitat. That is, the bulk of the information extant is contained within taxonomic articles, the titles of which do not disclose the habitats of the species treated.

Readers are encouraged to submit additional references based upon their familiarity with the taxonomic literature so that we may expand what we know to be only a first approximation of the existing information on the terrestrial arthropods of the salt marsh habitat.

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